Fort Funston Bank Swallow Colony
Analysis for Incidental Take Permit
Great Highway at Ocean Beach Repair Project
San Francisco
San Francisco County, California

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Introduction

The ocean bluffs at the north end of Fort Funston annually experience varying degrees of erosion during the winter months. Winter storms of 2009 to 2010 were particularly erosive in this area and began to undermine the south bound lane of the Great Highway between Sloat Boulevard and Skyline Boulevard. To prevent further undermining of the highway, the San Francisco Department of Public Works carried out an emergency repair by placing a 425 foot rock revetment below the worse section of bluff area.. The project was initiated in early February 2010 and completed by April 7, 2010. The bluffs where the erosion occurred provide a rare coastal nesting habitat for the Bank Swallow, a State listed threatened species.

The purpose of this document is to present information about the Bank Swallow population that nests annually in the cliffs of Ocean Beach near Fort Funston in San Francisco. This population is commonly referred to as the Fort Funston Colony and will be referred to as such throughout this document. There is very little published information on this colony, but much of what has been published is referenced. Other information was obtained from the ecologists at Golden Gate National Recreation Area (GGNRA), unpublished literature, and from local Audubon members who have kept a protective watch on this colony for many years.

Special Status Species Protection

The Bank Swallow (*Riperia riperia*) was listed on March 3, 1989 by the California Fish and Game Commission as a threatened species. Pursuant to Section 2070 of the Fish and Game Code a "threatened species" means a native species or subspecies of a bird, mammal, fish, amphibian, reptile, or plant that, although not presently threatened with extinction, is likely to become an endangered species. The elevation of any wildlife or plant species to "endangered" means that they are in serious danger of becoming extinct throughout all, or a significant portion, of their range due to one or more causes, including loss of habitat, change of habitat, overexploitation, predation, competition, or disease.

The State threatened listing of the Bank Swallow was based on a California Department of Fish and Game petition that provided documented evidence that the Bank Swallow had declined throughout its historical range in California, and was extirpated from approximately 50 percent of its historic range (primarily in Southern California). The Bank Swallow faced further reduction in populations and habitat due to ongoing bank protection projects on the Sacramento River, Feather River, and major tributaries (Garcia 1999). In 1992 the California Department of Fish and Game developed a Recovery Plan for the Bank Swallow. The Bank Swallow has no special status listing under the Federal Endangered Species Act but is protected under the Migratory Bird Treaty Act of 1918 (50 CFR 10.13).

Description of Bank Swallow

Bank Swallows, one of the smaller North American swallows, are about 5 ¼ inches long. They are white underneath and dark brown on the head, back, wings, and tail feathers and have a distinct dark brown band between their chin and belly. Plumage and overall appearance is similar in both sexes. They are distinguishable from most other swallow species in flight due to their swift, erratic flight alternating with rapid wing beats and short glides.

Bank Swallow Range

Bank Swallow breeding colonies are patchily distributed in Europe, Asia and North America (Turner and Rose 1989, Garcia 1999). In California, this species historically occurred as a localized breeder along coastal areas and rivers in central and southern California (Grinnell and Miller 1944). Breeding colonies that historically could be found at coastal sites from Santa Barbara County south to San Diego County no longer exist because coastal areas have been modified for human use and most of the rivers and natural waterways in Southern California have been converted into rock or concrete lined flood control channels (CDFG 1992).

In 1987 the California Department of Fish and Game conducted a statewide survey for Bank Swallow breeding colonies. The survey found that the Sacramento and Feather Rivers in the Sacramento Valley support 70 percent of the statewide population. This region has undergone a significant loss of Bank Swallow nesting habitat due to state and federal bank protection projects and agricultural activities (CDFG 1992). Other areas where Bank Swallow breeding colonies occur include the Klamath River Basin and Modoc County in Northeastern California. Only four colonies with a combined total of 1,960 burrows, were found south of San Francisco Bay with the southernmost colony located on the Salinas River in Monterey County (CDFG 1992).

Fort Funston Colony Background

The Fort Funston Colony is one of only two well-monitored populations of Bank Swallows that nest in ocean bluffs along the California coastline. The other breeding colony is located at Año Nuevo State Park in San Mateo County Park where burrow numbers annually fluctuate from 150 to 300. Access to the coast in the vicinity of the Año Nuevo colony is protected and restricted from human access during breeding season. There is a California Natural Diversity Data Base (CNDDB 2010) record (occurrence 159) for 4 burrows located near Jenner in Sonoma County in 1960 however there are no subsequent observations recorded in this area. Approximately 200 burrows were reported in Del Norte County on an Ocean Bluff near the Smith River in 2001 (CNDDB record 207) but again there are no follow up records for Bank Swallow this site.

The earliest record for the Fort Funston Colony dates back to 1905 (Laymon et.al. 1988). All records indicate that the colony has always been fairly small and the number of active

nests has fluctuated over time (see Table 1 below). From year to year the location of the colony, while staying in the same general area, shifts north and south for no known reason.

General Population Trends

In 1987 it was estimated that there are 111 breeding colonies in California with about 25,180 pairs (Laymon et al. 1988) with the majority occurring along the Sacramento River. Most colonies are small with usually fewer than several hundred pairs (Garrison 1999). Population size can vary greatly over relatively short time periods because of the ephemeral nature of nesting habitat and weather-influenced mortality on wintering grounds (Szep 1993, Garrison 1999).

Life Cycle Summary

A small numbers of bank swallows begin to arrive at Lake Merced annually during the first few days of April (D. Murphy, pers. com., Sandra Etchell, per. Ob.). The early arrivers forage for insects at various locations around the Lake. Bank Swallows are aerial feeders and forage from dawn to dusk capturing insects which comprise 99.8 percent of their diet. The number of arriving Bank Swallows steadily increases over the next two to three weeks and the first exploratory flights over the colony begin to occur. Birds arrive at colony sites in flocks of usually unpaired males and females, (Kuhnen 1985, Garrison 1999). The swallows generally spend much of the day foraging, gradually spending more time at the colony site as the season advances (Garrison 1999). Males investigate old burrows for suitability but given the harsh weather conditions at Ocean Beach and the highly erodible bluff face soils it is rare when burrows remain intact after the winter months (GGNRA 2000). The males settle into fixed area of nesting colony then choose a burrow site and begin nest scraping in mid-April (D. Murphy, pers. com.). Initially they dig only a shallow hole during early stages of the selection phase (Petersen 1955, Sieber 1980, Turner and Rose 1989, Garrison 1999). Females hover in front of burrows looking for prospective mates (Kuhnen 1985, Garrison 1999). Preferred burrows are visited by several competing females. Females already paired with males drive competing females off by spreading neck-feathers and displaying aggressiveness. Between May first to mid-June the Fort Funston Colony is most active with a variety of breeding activity including nest digging, egg laying, hatching of chicks, and fledging of young. In some cases early nests fail from any number of causes including collapsing of burrows, and predation of eggs or young (Dan Murphy, pers. com.). By July first to early August most nesting has been completed. Young roost in the nest burrow for approximately one week after fledging (Garrison 1999). After fledging and before fall migration, juveniles and adults roost together in trees, on exposed roots, in shrubs, and on logs on sandbars and gravel bars. After young fledge, birds gradually spend more time foraging away from colony sites each day, perhaps to familiarize themselves with the breeding colony, until migrating south (Garrison 1999).

Breeding grounds

Bank swallows breed primarily in lowland areas along ocean coasts, rivers, streams, lakes, reservoirs, and wetlands (Cramp et al. 1988, Turner and Rose 1989, Am. Ornithol. Union 1998, Garrison 1999) in vertical banks, cliffs, and bluffs in alluvial, friable soils. In inland areas, nesting colonies are also found in artificial sites such as sand and gravel quarries and road cuts (Garrison 1999). In coastal areas, waves caused by storms, tidal action, and wind erode cliffs, and bluffs, creating vertical faces and desirable Bank Swallow breeding habitat.

Colony-site selection probably is based on colony size and breeding success of the previous year. According to Garrison (1999), bank swallows begin to migrate from their winter range north to their breeding grounds in February. They travel in flocks comprised of other migrating swallow species (Garrison 1999).

The first flocks to arrive at the breeding colony consist of older male and female experienced birds visiting traditional nesting-colony sites. These early arrivers spend the first 2-3 weeks foraging and probably do not begin pair formation immediately. Later arriving birds visit the colony and start forming pairs immediately upon arrival (Garrison 1999). Those arriving during the next 1-2 weeks are mainly first year birds (Mead and Harrison 1979, Garrison 1999)

Colonies and Socialization

Bank Swallows are extremely social at all times, and seek out other individuals whenever they are away from the nest. While perched and preening in groups their shoulders often touch and during cold weather they sometimes huddle with their bodies pressed together. They have also been observed huddling with Tree Swallows (Meservey and Kraus 1976, Garrison 1999). In adverse weather, several adults may cluster together in small groups in burrows (Cramp et al. 1988, Garrison 1999). Typically colonies range from 10 to 2,000 active nests (Garrison 1999); they rarely nest solitarily (Hoogland and Sherman 1976, Cramp et al. 1988, Turner and Rose 1989). Colonial activities include coordinated foraging, territoriality, courtship, parent-offspring recognition, and predator avoidance (Emlen and Demong 1975, Windsor and Emlen 1975, Hoogland and Sherman 1976, Beecher et al. 1981a, Turner and Rose 1989).

Site-fidelity studies of banded Bank Swallows have resulted in the recapture ranging from 55.6% (n=20) in Illinois (Petersen and Mueller 1979) and as many as 92% (n=195) in Hungary (Szep 1990) of swallows returning to the breeding colony in subsequent breeding seasons (Garrison 1999). All these fidelity figures, however may underestimate colony fidelity because they are based on the number of recaptured birds that returned to the original colony, and it is unknown whether birds that do not return are dead, dispersed, or returned to the site but were not captured (Garrison 1999).

Preferred nesting sites

Older birds have greater choices of nest sites within the colony, and they settle in the best area of colony (Jones 1987). High-quality locations are higher up on the bank face in areas of firmer soils to reduce risk of predation and collapse (Sieber 1980, Jones 1987, Garrison 1999). Reproductive success is greater for higher burrows (Hoogland and Sherman 1976, Cramp et al. 1988). Colony site selection is thought to be based on colony size and breeding success of past years (Freer 1979, Garrison 1999).

Pair bonding

Pairs begin to match up as soon as birds begin visiting colony sites rather than during the foraging period that begins when birds arrive in the vicinity of the breeding grounds. Pair formation coincides with establishment of nest ownership or beginning of nest-building (Garrison 1999). When a female has chosen a male she regularly visits a particular burrow where she sporadically helps with excavation. While copulation occurs mostly in burrows, they also have observed copulating on the ground, the bank face, and in the air (Turner and Rose 1989, Garrison 1999). When the nest tunnel is dug, one member of the pair sits in the entrance facing outward. They begin to spend long periods of time together in the burrow. The pair sings twittering songs while perched side by side or facing each other at the burrow entrance. Once a pair bond has formed, paired males drive away intruding males. While protecting their female from insemination by other males, they search for opportunities for promiscuous copulations (Beecher and Beecher 1979, Garrison 1999).

Nest burrows

Males begin excavating a burrow before securing a mate. They dig only a shallow hole during the early stages of the mate selection process (Kuhnen 1985, Garrison 1999). When they have chosen a spot they begin to excavate a nest burrow using their bill, feet and wings (Stoner 1936, Garrison 1999). They cling to a slight projection on the bank face, and dig using their bill in a rapid, slashing motion and their feet in a scratching motion. Dislodged material from inside the burrow is ejected with vigorous kicks and wriggling body and wing shuffling movements. Burrow excavation takes 4 to 5 days (maximum 14) to complete, depending on weather conditions and soil (Sieber 1980, Turner and Rose 1989, Garrison 1999). Bank Swallows dig burrows parallel to the ground surface and perpendicular to the bank face. The depth of nest burrow averages 61.5 cm (Humphrey and Garrison 1987). Burrows in gravelly soils are often shallower than those in sandy, silty, loamy soils (Petersen 1955, Hickman 1979) and burrows in loose sand were deeper than those in compact sand. Deep burrows had greater breeding success than shallow burrows (Sieber 1980). Bank Swallows generally avoid reusing old nests because of the increased likelihood of infestation by fleas (*Ceratophyllus* spp.) (Haas et al. 1980). While excavating the burrow the male sing while flying in small circles around the burrow entrance to advertise to unpaired females. The male perches on the burrow ledge displaying his white throat-patch if a female lands near his burrow.

Males also attempt to attract females by overtaking them in flight then landing at their burrows to entice the females in. Males vacate burrows that do not attract females and establish new territories within the colony, thereby causing a surplus of burrows (Kuhnen 1985, Garrison 1999). Nest owners attack other birds that try to build a nest within 8-12 cm of their nest (Garrison 1999). Males dig most of the burrow and nest chamber while females build most of the nest (Garrison 1999). Once the burrow is excavated to the desired length the pair gathers nesting materials from the ground, and tear roots and rootlets from exposed roots on vertical banks (Petersen 1955). The process of burrow excavation and nest building takes up to 14 days. From the start of nest-building through beginning of egg-laying, the pair usually roosts in nest burrow (Garrison 1999).

Eggs

Bank Swallows are capable of breeding in the first year after fledging. The females lays an average of 4 small white eggs measuring 17.2 x 12.4 mm.(Garrison 1999).
The female begins incubation 1 to 2 days before the clutch is complete. Incubation lasts from 13 to 15 days (Garrison 1999). The female does the majority of incubation. The male takes over only on the rare occasions when the female leaves the nest. Eggs can tolerate relatively cold temperatures and interruptions in incubation; the burrows provide some protection from extreme cold and heat (Ellis 1982). Hatching of the entire brood takes 2 to 3 days (Petersen 1955). Adults remove eggshells from the nest after hatching is completed (Petersen 1955). Fragments of eggshell accumulate on the ground at the base of the cliff. Typically Bank Swallows only produce one group of offspring per year; however if nest failure occurs, the pair will re-establish a nest during the early or middle stage of the breeding season (Garrison 1999).

Nestlings

Both pairs feed the nestlings after they hatch and continue to feed for about 3 to 5 days after they have fledged (Garrison 1999). The parents endure a rigorous feeding schedule – intervals between feedings range from 15 seconds to 25 minutes resulting in an average feeding rate of 24 to 35 feedings per day for 3 to 4 nestlings (Moreau and Moreau 1939, Petersen 1955, Garrison 1999). Under normal circumstances nestlings are not left alone for more than 1 to 5 minutes (Moreau and Moreau 1939, Hickman 1979, Garrison 1999). Bank Swallow young develop rapidly and by 8 to 10 days old can sit erect and scoot from the nest to the burrow entrance where they wait to be fed by the adults (Petersen 1955, Garrison 1999). They build up strength for flight by stretching and flapping their wings throughout the later stage of their development and are able to fly when leaving the nest for the first time (Garrison 1999).

Fledglings

The young fly from the nest for the first time when they are about 22 days old (Garrison 1999). Parents feed juveniles on an irregular basis after they have fledged and stop feedings altogether about one week after the young have fledged (Petersen 1955, Cramp et al. 1988, Garrison 1999). They return to their nest burrows or neighboring burrows for

about 4 to 5 days after their first flight to rest and roost with siblings and other fledgling Bank Swallows from the colony (Petersen 1955). Juveniles have been observed roosting in their natal burrows as old as 28 days (Petersen 1955) and most are independent of their parent as at 30 days old (Cramp et al. 1988). After they fledge they mix with the adults and juveniles that remain at the colony (Freer 1977, Garrison 1999) while they continue to increase the frequency and duration of flight in preparation for the impending migration south. When not foraging, juveniles spend their time preening and roosting often perching on nearby logs or branches or sunbathing on the beach within the vicinity of the colony (Turner and Bryant 1979). They often practice copulation, burrow excavation, nest-building, and brooding (Garrison 1999).

Winter Range and Migration

There have been no tracking studies of the Fort Funston Colony to see where the Bank Swallows go after breeding season is over but it is likely that they follow the same migration route that Sacramento and other California populations utilize. Their winter range is primarily in South America, extending almost the entire length of the continent south to north and from central Chile and north Argentina (Ridgely and Tudor 1989; Garrison 1999). They are also known to winter along the Pacific slope of southern Mexico. Bank swallows are diurnal migrants and migration to breeding grounds and back to wintering grounds spans several months with a peak time of early August to late September. Juveniles begin fall migration earlier and continue later than adults (Garrison 1999). Their migration route presumably follows the Central America isthmus between North and South America where they are primarily observed in coastal and lowland regions (Garrsion 1999).

Life Span

Several survivorship studies have been conducted by fitting captured Bank Swallows with a numbered or coded leg band. The various studies have yielded significantly different results. The average annual mortality rate resulting from a study conducted on banded Bank Swallows in Sweden was 67.0% for juveniles and 59.7% for adults (Persson 1987). Using live recaptures of Sand Martins (the British name for Bank Swallows) in Great Britain, Harwood and Harrison (1977) and Cowley (1979) estimated average first-year mortality of 80 and 77% and annual adult mortality of 60 and 58%, respectively (Garrison 1999). There are 2 records of Bank Swallows living at least 9 years (Petersen and Mueller 1979, Szep 1992, Garrison 1999) although typically in the wild their average life span is 2 to 3 years with five years being exceptional. Causes of death include disease, body parasites, mites, internal parasites, exposure, predation, and collisions with vehicles or windows. Eggs and nestlings are often lost when burrows collapse or erode from either natural or human caused events. Other species sometimes compete for nest burrows which can cause indirect loss of this species (Gross 1942, Garrison 1999).

Predation

Predators observed taking individuals of the Fort Funston Bank Swallow colony include common ravens, American kestrels, red-tailed hawks, and red-shouldered hawks (Bill Merkle, pers. com.).When threatened by aerial predators, Bank Swallows give a high-pitched warning call which causes other members of the colony to form a loose flock which in turn begin uttering alarm calls. Upon hearing the alarm calls nestlings perched at the burrow openings retreat tail first back into the burrow (Garrison 1999). Predators are rarely dissuaded by mobbing behavior by Bank Swallows. Larger colonies are more effective at this behavior than smaller colonies because of the opportunity for early detection and greater numbers of birds participating in mobbing (Garrison 1999). American Kestrels take vulnerable, young fledglings in the air by flying into mobbing flocks or chasing birds singled out from aerial groups (Windsor and Emlen 1975). They also take nestlings from burrow entrances or reach into the burrow with one foot and pull the nestlings out. (Windsor and Emlen 1975, Szep and Barta, 1992, Garrison 1999)

Occasionally other birds may take over burrows dug by bank swallows for nesting. Barn owl (*Tyto alba*), Belted Kingfisher (*Megaceryle alcyon*), Northern Rough-winged Swallow, and Cliff Swallow have been documented as nesting in Bank Swallow burrows (Lunk 1962, Garrison 1999).

Human Caused Disturbance

Unlike the Sacramento populations which typically nest in reaches of the Sacramento River and tributaries where human caused disturbance to colonies is less of a problem than habitat loss; human caused disturbance is the primary cause of nest failure of the Fort Funston colony. Documented human caused disturbance of the Fort Funston Colony include: cliff-climbing by people and dogs; rescue operations of people and dogs stuck on the cliff face; people and dogs on the bluff above the colony or in close proximity to the burrows; graffiti carving in the cliff face; aircraft and hang-glider over-flights; and discharge of fireworks within the colony (GGNRA 2007). The potential impacts from such disturbances include: interruption of normal breeding activity, such as feeding of young; crushing of burrows near the top of the cliff face (nests can be located within a foot of the bluff top); accelerating human-caused bluff erosion; and active sloughing and land-slides that may block or crush burrows and the young inside (GGNRA 2007).

The 2010 Nesting Season

South Colony

A few Bank Swallows were first spotted returning to the vicinity of the Fort Funston breeding site at Lake Merced on April 1, 2010 (Sandra Etchell, pers. obs.). Around April 10 swallows began to excavate burrows at the South Colony (see Photo 6) approximately 440 feet south of the rock revetment. By April 23 there were 37 burrows situated in the middle of the bluff. It was noted by all who surveyed this location that it was highly

erosive and that by May 3 some of the colony area was beginning to collapse. By May 10 there were a total of 102 burrows but by May 19 the bluff top above the colony collapsed down onto the colony obliterating most of the burrows.

Middle Colony

Burrows at the Middle Colony were established about the same time as the South Colony with about 52 excavated burrows. The majority of the nests were situated mid bluff there were also about 10 nests on the upper slope only two or three feet below the bluff top. About half of the burrow entrances (see Photo 4) were enlarged by a few inches and there were no active nests mid-bluff on July 12. There is a possibility that the nest entrances were excavated by ravens with the intention of extracting chicks but there is no hard evidence that this indeed happened. There were two active nests observed near the top of the bluff during the July 12 survey. There were two active nests in this same area during an August 4 survey.

North Colony (Over Revetment)

Bank Swallows were observed excavating burrows on May 18 at the south end of the rock revetment in the cliff above the rock (Barbara Leitner, pers. com.) There is about 12 feet of exposed bluff face above the revetment. By July 12 there were about 50 burrows with 10 active nests remaining. No active nests were observed in this area during an August 4 survey.

As of September 2010 GGNRA had not assimilated data collected by volunteers during the 2010 Bank Swallow breeding season therefore GGNRA numbers may differ. Table 1 below represents the number of burrows and the years in which they were recorded at the Fort Funston Colony. Some of the later numbers are differing depending on which document they were taken from but there was no significant difference in the numbers.

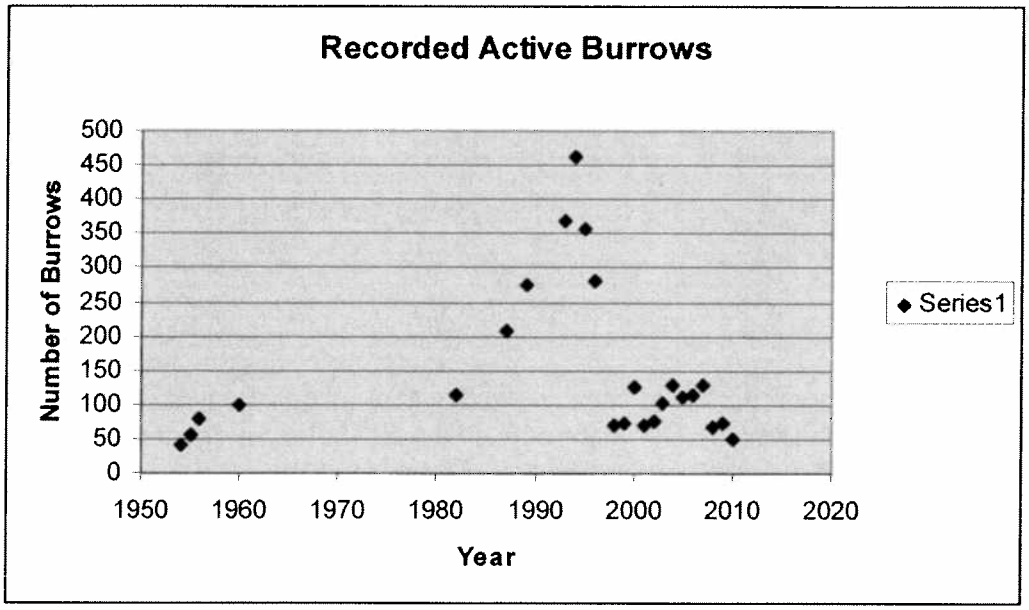
Table 1. Number of Actual Burrows Recorded

Year	Number of Burrows
1954	84
1955	114
1956	157
1960	196
1982	229
1987	417
1989	550
1990	no data
1991	no data
1992	no data
1993	739
1994	924
1995	713
1996	561
1997	no data
1998	140
1999	148
2000	253
2001	142
2002	150
2003	203
2004	255
2005	220
2006	229
2007	256
2008	132
2009	148
2010	102 (no data from GGNRA)

Approximately 40 to 60 percent of burrows are actively used for nesting in a give year (GGNRA 2007).

Fort Funston Bank Swallow burrows reached the highest numbers recorded in the mid-1990's (Figure 1). There is no data to predict why those were particularly successful years, perhaps weather was a primary factor. The 2010 Bank Swallow breeding season resulted in one of the least successful years on record.

Figure 1. Number of approximate recorded active burrows (based on a 50% occupancy rate of actual burrows).



Soil Sieve Tests

Four soil samples were taken at the North colony after the 2010 Bank Swallow breeding season was completed. The results are included in Appendix 1. Three of the four samples taken consisted of fine brown sand with trace silt/clay and were weakly cemented. The fourth sample taken consisted of brown fine sand with silt. In general, fine sand possesses relatively high permeability. With the inclusion of a small amount of binder (trace to slight amount of silt and/or clay), the relative permeability should not be significantly altered, if at all. This small amount of binder acts like a weak glue on the sand grains (weak cementation) – the sand remains relatively stable and friable when dry; therefore a burrow remains open during dry weather. When water is introduced to the sand, the water flows through the highly permeable sand rapidly, thus weakening the already weak cement, thus causing collapse of the burrow (Robert Chew, pers. com.)

Attempts to Protect the Fort Funston Colony

Visitors to GGNRA's Fort Funston Park often knowingly and unknowingly disturbed the Bank Swallow breeding colony by climbing up to the nests, or jumping from the bluff top to the sand below; carving graffiti and sculptures into the bluff, and harassing birds with rocks and fireworks. GGNRA staff constructed barriers in deep gullies which were being used by the public to scale the cliffs from the beach. In 1998 a fence was placed three feet back from the edge of the bluff top to prevent people from disturbing the Bank Swallow nests from above (GGNRA 2000). Interpretive signs describing the Bank Swallows, their status as a protected species, and their use of the Fort Funston Cliffs as nesting habitat were posted along the fence. The fence did not prevent recreational disturbance to the colony, in fact, National Park Service staff observed increased erosion due to visitor use

adjacent to the fence line (GGNRA 2006). In addition, the fence posts provided convenient perches for ravens and other birds that frequently harass or predate the colony. Natural erosion of the bluff face, estimated by the Park Service to occur at a rate of approximately one foot per year, caused the fence to collapse and fall within a few months (GGNRA 2006).

During the fourth of July holiday, to decrease disturbance to the colony, GGNRA staff closed two parking lots near the colony to eliminate easy access to the beach area. Law enforcement rangers patrol the nest site to confiscate fireworks and direct the public away from the area (GGNRA 2000).

GGNRA has established a 12-acre area of permanent closure on the bluff top just south of the area where the Bank Swallows nested in 2010. Interpretive signs are posted on the beach to establish a 50 foot buffer zone between human activity and the nest colony. The signs request that park visitors stay 50 feet back from the cliff. There are no permanent measures in place at the top of the bluff to prevent visitors from walking above the Bank Swallow Colony (Sandra Etchell, pers. ob.).

GGNRA established an annual monitoring program in 1993 to track the abundance and distribution of the Fort Funston Colony (GGNRA 2006). Park service staff and volunteers post signs on the beach to establish a 50 foot buffer zone. The signs provide a brief history of the Bank Swallow population that nests there and requests that people not encroach into the buffer zone.

GGNRA prohibits hang gliders from flying over the nesting area during breeding season to reduce colony disturbance (GGNRA 2006).

Conclusion

The Fort Funston Colony is attracted to this general area of Ocean Beach because of the vertical bluff face and penetrable sandy soils of which the bluffs consist. A search was conducted for potential Bank Swallow nesting habitat as far as two miles south of the Fort Funston colony. There are a few similar bluffs and soils but they do not provide much horizontal distance (Sandra Etchell, pers. obs). Another deterrent for nesting in this area is likely due to the frequent presence of hang gliders that traverse the ocean front in this location. There were no areas that were not trafficked by hang gliders along the entire two mile area (Sandra Etchell, pers. obs.). Bank Swallow nesting at the Fort Funston colony was disturbed by overflying hang gliders therefore it is possible that the abundance of hang glider activity south of the colony discourages nesting attempts.

Attempts in the form of barriers to prevent human activity on the bluff above the Fort Funston colony are often penetrated or damaged by high winds thus becoming ineffective. People on the beach express awareness of the colony and tend to ignore it (Sandra Etchell, pers. obs.) although GGNRA monitor logs reveal that this is not always the case.

Ravens are a constant presence on the beach and continuously fly over and along the bluff face foraging on trash and dead wildlife on the beach. It is highly likely that they disrupt Bank Swallow nesting with their aggressive presence. They frequently fly over the colony and have been observed trying to get at chicks in nest burrows (Dan Murphy, pers. com.).

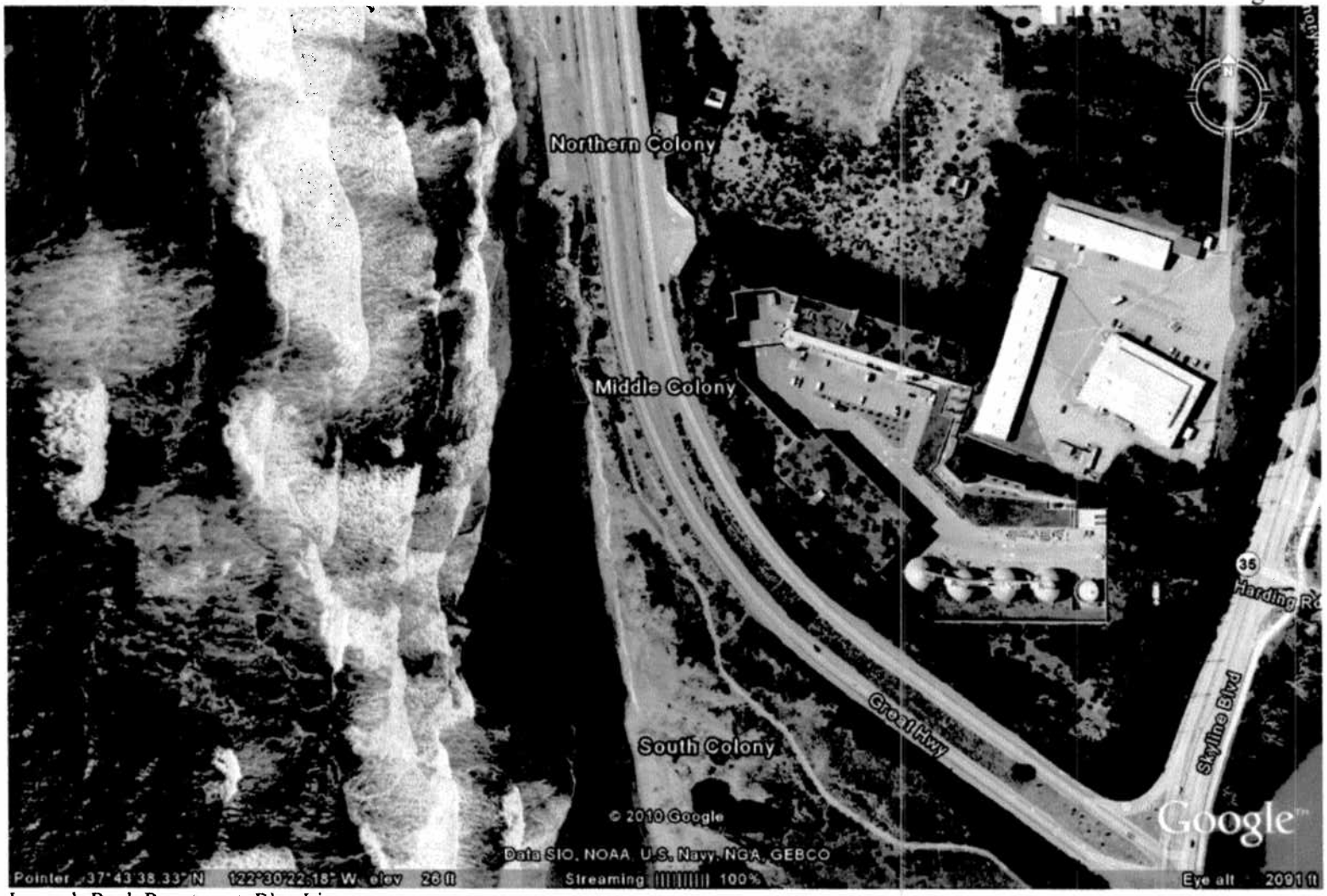
The same erosive nature of the preferred soils in which the Bank Swallows construct their burrows periodically results in the collapse of all or portions of the colony. Such was the case for the 2010 colony. A study conducted along the Sacramento River where banks were enhanced or created to encourage Bank Swallow nesting indicated that such measures resulted in some success, however the cost of maintenance of such sites led to abandonment of the effort (Garrison 1991).

These causes that decrease the nesting success of the Fort Funston Bank Swallows are difficult to resolve. While methods to prevent people from accessing the bluff top during breeding season may be the most easily remedied problem, devising methods to prevent disturbance by ravens is more of a challenge. If indeed ravens were successful at extracting Bank Swallow chicks from the nest burrows during the 2010 breeding season, it is likely that they will continue such behavior in the future.

The results of data collected during the 2010 Bank Swallow breeding colony at Fort Funston indicated that is one of the least successful seasons on record. Without knowing more information, such as how many individuals make up the colony and whether they return to the same site annually, whether there are recruits from other colonies, and any other number of factors, it is impossible to predict the viability and continued use of the Fort Funston bluffs as a breeding site.

The 425 foot rock revetment placed by the San Francisco Department of Public Works did not prevent the bank swallows from utilizing the site as nesting habitat. The soils above the rock are more stable than soils found at middle and south colony and the rock will decrease the potential for erosion of the bluff face and therefore, bank swallow nesting habitat in this area.

2010 Bank Swallow Fort Funston Bank Swallow Colonies Figure 1



Legend: Rock Revetment Blue Line
Red Triangles Bank Swallow Colony Locations

Photographs of 2010 Bank Swallow Colony

Photo 1: Northernmost colony above revetment Taken 8/4/10

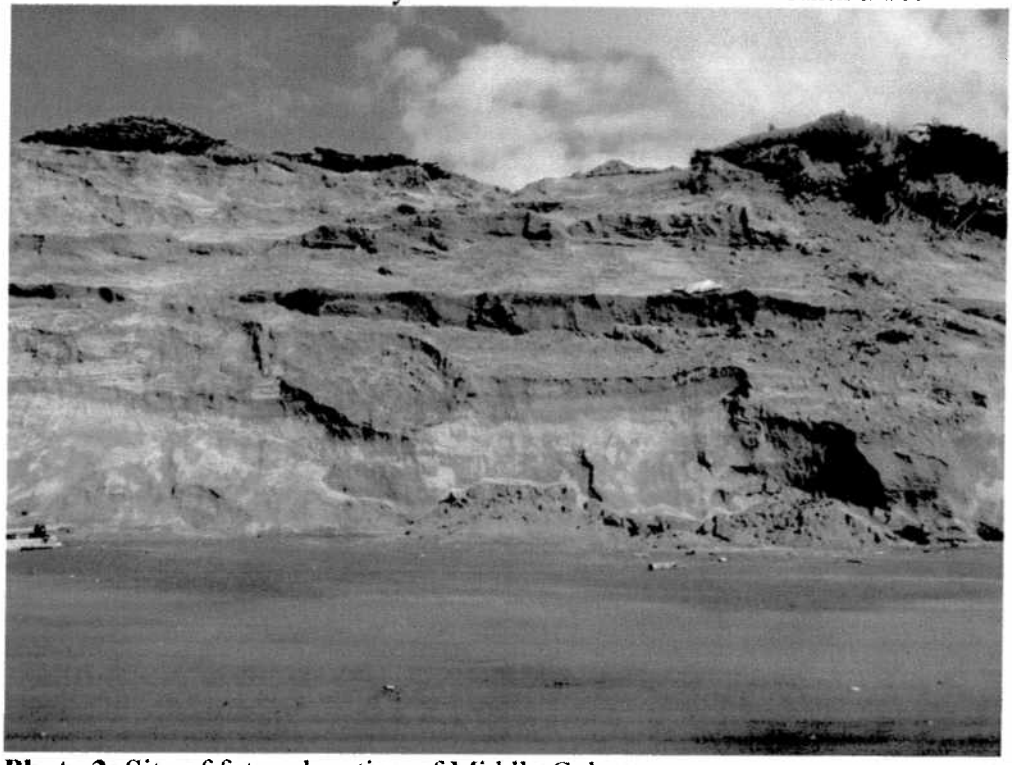


Photo 2: Site of future location of Middle Colony Taken 2/9/10

Photo 3: Middle Colony Taken 5/19/10

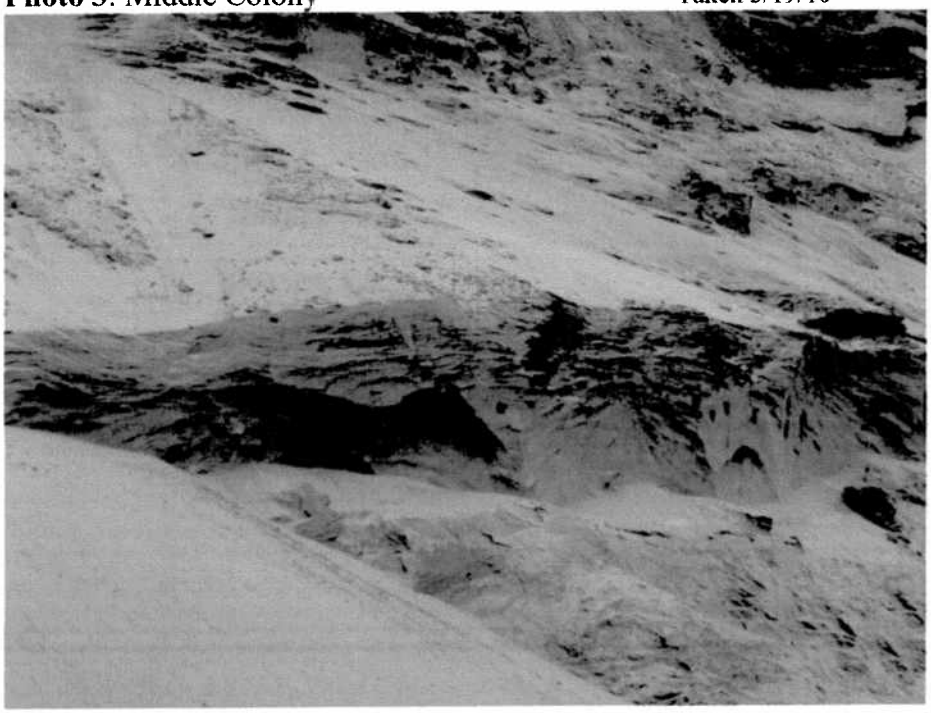


Photo 4: Middle Colony Taken 8/4/10

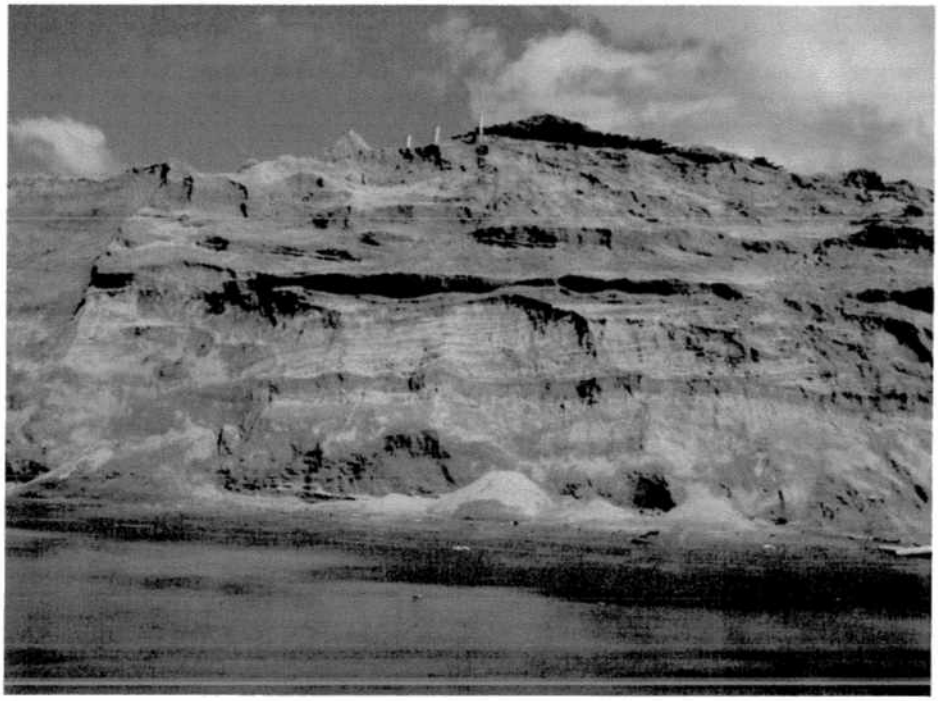


Photo 5: Future site of Southernmost (collapsed) Colony Taken 2/9/10

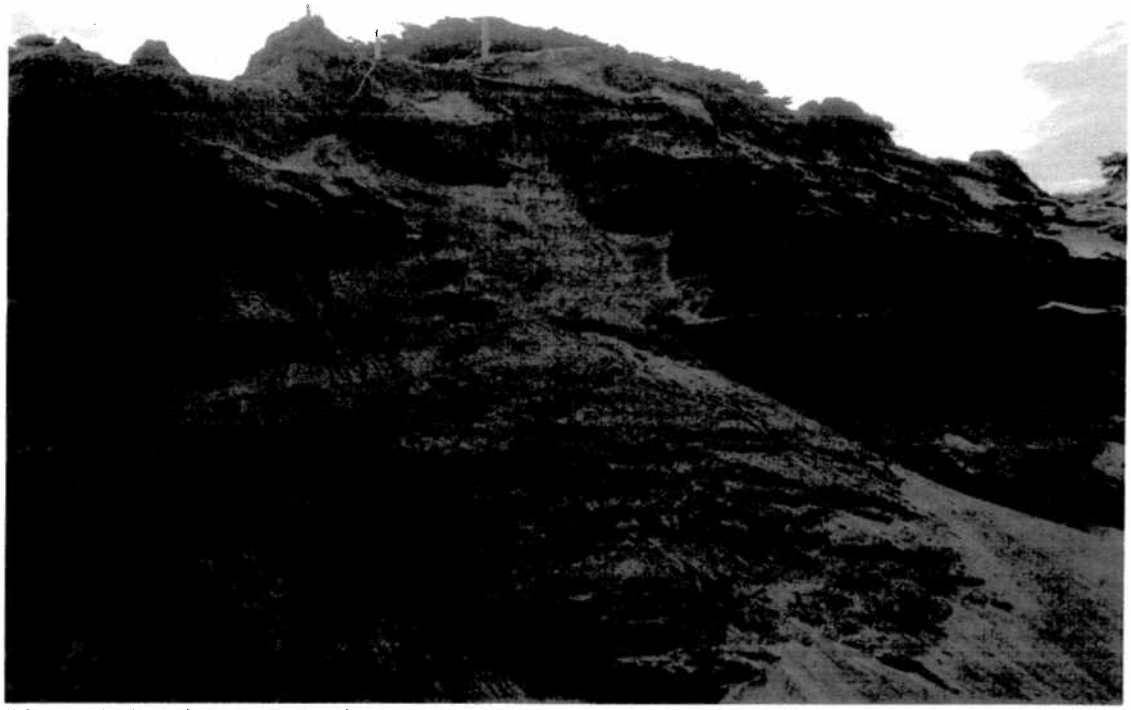


Photo 6: Southernmost colony Taken 5/19/10

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